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ABSTRACT

This study examined the relationship between children's gender-typed conversational styles and joint problem-solving performance. Sixty preschool children between 4 and 5 1/2 years completed three problems with a same-sex or opposite-sex peer. Two structured tasks, copying a Tinkertoy model and stringing beads; and one unstructured task, building a Tinkertoy structure of their own design, were videotaped. Children's conversations were analyzed for gender-typed language content, including aggressive and mitigated speech. Behavioral measures included children's success or failure for selection and placement of task pieces, behavior involving materials, and overall success. Findings indicated that there were no pair type or task differences in problem-solving success. Girls used mitigation more than boys but there were no differences in aggressive speech. Mixed-sex dyads used a masculine, aggressive conversation style more than same-sex dyads. Children used more mitigation and less indecision on the bead task than on other tasks. There were differences in verbal and behavioral measures associated with success on each task. Giving reasons on the model-copying task was associated with more correct selections for female pairs, but with worse overall performance for male pairs. Miscellaneous talk on the model-copying task was associated with correct selections for female pairs but with incorrect selections and placements for mixed-sex pairs. Mitigated speech on the model-copying task was negatively correlated with overall performance for mixed-sex pairs. For the bead task, performance for male pairs was negatively related to aggressive talk. For the open-ended Tinkertoy task, aggressive and mitigated speech was related to selections or placements for mixed-sex dyads. (Contains 27 references.) (KDFB)

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Preschool Children's Collaborative Problem-Solving Interactions: Influence of Task, Partner Gender, and Conversational Style

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Abstract

The general aim of this project was to investigate the relationship between children's gender-typed conversational styles and their joint problem-solving task performance. Preschool children between the ages of 4 and 5 1/2 years of age completed three problem-tasks with either a same-sex or an opposite-sex peer. Children's conversations were analyzed for their gender-typed language content, including the use of aggressive and mitigated speech in conflict resolution. Girls used mitigation more often than boys. Mixed-sex dyads used a masculine, aggressive style of conversation more often than same-sex dyads. While children's overall performance did not differ across the three tasks, there were differences in the verbal and behavioral measures that were associated with success on each task. The relationships between these measures and task performance also differed across pair types. The results of the study indicate that preschool children do utilize collaborative skills in joint problem-solving interactions, and that the use of these skills across different tasks and in a variety of contexts deserves further study.

Introduction

It is generally accepted that peer collaboration is often beneficial for children's learning (Azmitia, in press; Azmitia & Perlmutter, 1989; Rogoff, 1990; Tomasello, Kruger, & Ratner, 1993). A few studies have examined the role peer collaboration might play in preschool children's cognitive development (Azmitia, 1988; Brownell & Carriger, 1991; Muller & Perlmutter, 1985). To date, however, there has been little investigation of the processes of preschool children's joint problem-solving, particularly with respect to gender differences in styles of interaction.

Previous research on preschool children's free play interactions has shown that girls and boys differ in how they use language, particularly during conflict episodes (Maccoby, 1990; Sheldon, 1990). Girls are more likely to try to defuse or mitigate conflicts by using strategies like clarifying the other person's feelings, changing the topic, or offering compromises (Miller, Danaher, & Forbes, 1986). Girls also use moderate, verbal persuasion tactics rather than heavy-handed physical persuasion tactics. Boys, on the other hand, are more likely to use threats or physical force to persuade (Hartup, French, Laursen, Johnston, & Ogawa, 1993; Killen & Naigles, 1993; Kyratzis, 1992). Boys are also more likely to issue direct commands, and are are less likely to provide rationales for assertions (Hartup et al., 1993; Killen & Naigles, 1993).

These differences may become particularly important when boys and girls must interact with one another in mixed-sex contexts. Studies of children in play contexts have shown that females may be dominated by males in such situations (McCloskey & Coleman, 1992) or that girls may react by becoming more assertive (Goodwin, 1987; Leaper, 1991; Miller, et al., 1986).

Some studies have examined children's mixed-sex problem-solving interactions (Barbieri & Light, 1992; Cannella, 1992; Holmes, 1997; Hughes, Brackenridge, Bibby, & Greenough,

1988; Littleton, Light, Joiner, & Barnes, 1992; Madhok, 1992; Pozzi, Healy, & Hoyles, 1993; Underwood, McCaffrey, & Underwood, 1990). However, there has been no research with preschoolers in a cognitive problem-solving context that has explored gender differences in conflict resolution or task performance. This is an important area of study, because the language differences that exist between boys and girls may influence cognitive development as well as free play behavior. If gender differences in conflict resolution affect girls' problem-solving performance, their confidence and their ability to perform well in school, where girls and boys are often asked to work together, could be affected (see Sadker & Sadker, 1994).

The goal of the present study was to investigate the relationship between gender-typed features of children's interactions and children's performance on cognitive problem-solving tasks. A further goal was to extend this research to a preschool sample to determine whether the gender differences in language that are already apparent by this age are affecting young children's cognitive performance. A final goal was to compare children's conversational styles and task performance on three different problem-solving tasks. We have little information about how task differences might influence same-sex versus mixed-sex collaborative processes and outcomes. For example, tasks that force children to work together more often during the interaction might generate different types of discussion or behavior than tasks that allow children to work more independently.

Method

Participants

Participants were 60 children between the ages of 3 years 11 months and 5 years 5 months (mean age = 4 years 8 months). Children were randomly assigned to one of three types of dyads: 10 same-sex boy dyads, 10 same-sex girl dyads, or 10 mixed-sex dyads. All dyads

were formed within classrooms, and had a maximum of a 6-month age difference between partners.

Procedure

Each child participated in one testing session with either a same-sex or an opposite-sex partner. All sessions were conducted by a female experimenter at the children's school, and lasted approximately 20 minutes. The children participated in three tasks: two structured problem-solving tasks (copying a Tinkertoy model and stringing colored wooden beads) and one unstructured task (building a Tinkertoy structure of the children's own design). All sessions were videotaped.

Scoring

Language Measures

Children's conversations were coded using categories from Eisenberg and Garvey (1981) and Goodwin (1988), as well as categories developed by the author. The following language categories were used:

1. Aggressive--Giving a direct command, challenge, or threat. Also included ignoring the partner.

2. Mitigated--Giving a suggestion, offering a joint plan or compromise.

3. Information--Asking for or receiving task-related information

4. Miscellaneous--Off-task comments; comments about the task that were not related to task completion.

5. Counter--Verbal disagreement with partner.

6. Agreement--Verbal agreement with partner.

7. Reason--Speaker gives a reason for his or her behavior or why some particular course of action should be pursued.

8. Experimenter--Talk directed toward the experimenter.

Behavioral Measures

Children's behavior was scored in several ways. First, children's success or failure for selection and placement of individual task pieces was scored for the model-copying Tinkertoy task and the bead task. Children's behavior involving task materials was also scored. The following categories were used:

1. Selection of piece (scored as correct or incorrect for model-copying version of the Tinkertoy tasks and the bead task).

2. Placement of piece (scored as correct or incorrect for model-copying version of the Tinkertoy tasks and the bead task).

3. Aggressive--Taking a piece from the partner, rejecting a piece that was taken from or offered by partner, blocking the partner's attempt to select or place a piece.

4. Mitigated--Offering a piece to partner, taking a piece offered by the partner, offering a piece in response to partner's command.

5. Indecision--Attempting a placement, removing or replacing a piece that was removed, selecting a piece and then rejecting it.

6. Gesture toward model or piece.

Overall Task Success

Task success was scored for the bead task and the model copying version of the Tinkertoy task. Task success was measured by dividing the number of Tinkertoy pieces or beads

correctly placed by the total number of pieces or beads placed. Pieces or beads that should have been placed but were not were counted as incorrect placements.

Reliability

All scoring was done by the author. For the language measures and the behavior measures, a random sample of 30% of the dyad transcripts was independently coded by a female undergraduate research assistant for interrater reliability. Reliability ranged from .73 to .91 for the discussion categories (average reliability = .82). Reliability figures for the behavioral categories were between .80 and .95 (average reliability = .88).

Results

The analyses were directed to three goals. The first was to determine whether there were pair type differences for the language categories or the behavioral measures. The second was to examine gender differences across both types of measures. The final goal was to test for relationships between the language measures and the behavioral measures with a series of correlation matrices. All analyses were performed using frequency scores for each of these categories.

Pair Type Differences

The length of children's discussions was measured by the number of conversational turns. Each utterance by a child that was bounded by either a pause in the conversation or an utterance by the other child was considered a turn. For the model-copying Tinkertoy task, children averaged 24.78 turns, on the open-ended Tinkertoy task, children talked for an average of 23.05 turns, and children averaged 17.48 turns on the bead task. No differences were found across pair types.

To analyze for differences in the overall success measure for the model-copying Tinkertoy and bead tasks, the ratio scores for success were subjected to a 3 (Pair Type: Same-Sex boys, Same-Sex girls, Mixed-Sex) x 2 (Task: Tinkertoy, Bead) mixed-model ANOVA. There were no significant differences in performance across pair type. Results also did not reveal significant differences in performance for the two tasks. ($\underline{M}$ = .74 for the model-copying Tinkertoy task and $\underline{M}$ = .70 for the bead task).

Each of the eight language categories and eight behavior measures (six for the open-ended Tinkertoy task) was subjected to a 3 (Pair Type: Same-Sex girls, Same-Sex boys, Mixed-Sex) x 3 (Task: Model-Copying Tinkertoy, Open-ended Tinkertoy, Bead) mixed-model ANOVA. Separate ANOVAs were conducted because the a priori comparisons of interest were the effects of pair type and trial on each variable individually, rather than comparisons within the language categories or within the behavior categories.

The analyses for the language categories revealed a significant main effect of trial for the information category. Children asked for or received more task-related information more often on the Tinkertoy tasks ($\underline{M}$ = 6.90 for the model-copying Tinkertoy task and $\underline{M}$ = 6.13 for the open-ended Tinkertoy task) than the bead task ($\underline{M}$ = 4.48).

For the behavior categories, a main effect of pair type was significant for aggressive behaviors. Mixed-sex dyads engaged in these behaviors almost twice as often ($\underline{M}$ = 4.02) than either same-sex female dyads ($\underline{M}$ =2.00) or same-sex male dyads ($\underline{M}$ = 2.68). This finding is consistent with previous research indicating that mixed-sex interactions often involve a clash of collaborative styles that boys and girls develop in same-sex interactions, and children may alter their behavior with other-sex partners as a result.

A main effect of trial was also significant for several of the behavioral categories. Children used more mitigated behaviors on the bead trial ($\underline{M}$ = 4.13) than on either of the Tinkertoy trials ($\underline{M}$ = 2.08 for the model-copying task and $\underline{M}$ = 1.50 for the open-ended task). Since the bead trial typically involved only one child putting a bead on the string at a time, more of the materials needed to be passed back and forth between the children than on the Tinkertoy trials.

The main effect of trial was also significant for the indecision category. Here, children used more indecisive behaviors on the Tinkertoy tasks than on the bead task ($\underline{M}$ = 16.07 and $\underline{M}$ = 16.75 for the model-copying Tinkertoy task and the open-ended Tinkertoy task, respectively, and $\underline{M}$ = 3.73 for the bead task). Children were more likely to change the locations of task materials on the Tinkertoy trials than on the bead trials, in part because removing materials on the bead trial involved removing more than one bead, while Tinkertoy pieces could easily be moved one at a time. In addition, there were more pieces involved on both the Tinkertoy trials than on the bead trial, so there were more decisions to be made by the children and consequently more opportunities for those decisions to be altered.

Trial differences also emerged on the categories used to code correct and incorrect selections and placements for the model-copying Tinkertoy task and the bead task. A main effect of trial was significant for both correct and incorrect selections. Children made more correct and incorrect selections on the Tinkertoy task ($\underline{M}$ = 8.38 and $\underline{M}$ = 9.23, respectively) than on the bead task ($\underline{M}$ = 6.05 for correct selections and $\underline{M}$ = 2.23 for incorrect selections). These same trial effects were significant for the placement measures. Children again exhibited higher frequencies of correct and incorrect placements on the Tinkertoy task ($\underline{M}$ = 6.67 and $\underline{M}$ = 5.13,

respectively) than on the bead task (M = 4.48 for correct placements and M = 1.58 for incorrect placements).

Gender Differences

The second goal for the analyses was to simultaneously test for differences across both gender and pair type. However, these analyses could not be performed on all 60 children because the data from same-sex pairs were not independent and because the pair types were not fully crossed. To address this issue, the scores for children in same-sex pairs were averaged, so that 20 sets of scores from same-sex dyads were compared with 20 sets of scores from mixed-sex dyads.

As with the analyses that examined pair type alone, each of the language and behavior categories was tested separately. Each analysis was a 2 (Pair Type: Same-sex, Mixed-sex) x 2 (Gender: Male, Female) x 3 (Trial: Model-copying Tinkertoy, Open-ended Tinkertoy, Bead) mixed-model ANOVA. For the language categories, a main effect of gender was significant for children's mitigated speech. Girls in both same-sex and mixed-sex pairs used more mitigated speech (M = 3.36) across all three trials than did boys (M = 2.04). This finding supports previous research on gender differences in children's language use, and provides the first evidence that such differences exist for preschool children's problem-solving interactions.

A main effect for pair type and a main effect for trial were also significant for the information language category. Mixed-sex dyads offered and requested more information from their partners (M = 7.02) than same-sex dyads (M = 5.25). Children also offered and requested information from one another most often on the model-copying Tinkertoy task, followed by the open-ended Tinkertoy task and the bead task. Means for these trials were 7.13, 6.63, and 4.61, respectively.

Correlations

The third goal for the analyses was to examine relationships among the language measures and the behavioral measures, including various measures related to task performance. These relationships were examined using a series of correlation matrices. Because the relationships between language and behavior depend upon contributions to the interaction made by both members of the dyad, correlations were performed on dyad scores for both measures. The dyad scores were computed simply by summing the individual frequency scores for each member of the dyad. Correlations were performed within pair type and were conducted separately for each trial, resulting in a series of 9 matrices.

On the model-copying Tinkertoy task, giving reasons was associated with more correct selections for same-sex female pairs, but was associated with worse overall performance for same-sex male pairs. This finding suggests that offering justification for a particular course of action may be beneficial for girls' performance but detrimental to boys' performance. For this task as well, counters were negatively associated with overall performance for same-sex female dyads, but not for same-sex male dyads or mixed-sex dyads. Girls tended to perform worse, therefore, when frequent disagreements occurred during their interactions with one another. Miscellaneous talk in same-sex female dyads, however, was positively correlated with correct selections.

For mixed-sex pairs on this task, several correlations are of interest. First, mitigated speech was negatively correlated with overall performance. Mitigated speech was also positively correlated with incorrect selections and incorrect placements. Mitigated speech, then, seems to negatively affect performance when boys and girls interact with one another, but not in same-sex interactions. Finally, miscellaneous talk was associated with incorrect selections and

placements. Talk not directly related to completing the task, then, seems to serve a positive function for female dyads but may inhibit performance when girls interact with boys.

For the bead task, the correlations revealed different patterns of results from those for the model-copying Tinkertoy task. For example, performance for same-sex male pairs was negatively associated with aggressive talk. Aggressive speech was positively correlated with incorrect selections and incorrect placements. Counters were also positively correlated with incorrect selections and placements for male dyads. Reasons were positively correlated with correct selections and overall performance for same-sex male dyads on the bead task, but not for female dyads as was the case for the Tinkertoy task.

For the open-ended Tinkertoy task, several correlations were significant for mixed-sex dyads. Aggressive speech was positively correlated with selections and placements. Mitigated speech was also positively correlated with selections for these dyads. In the open-ended task, then, both mitigated and aggressive speech were associated with behaviors necessary to complete the task. Finally, agreements were associated with higher frequencies of mitigated behaviors. For the same-sex dyads, reasons were correlated with aggressive behaviors in male dyads.

Discussion

The present research provides the first information about the relationship between preschool children's gender-typed conversational styles and their collaborative problem-solving performance. Girls in both same-sex and mixed-sex dyads did engage in more mitigated conversation than boys. Boys, however, did not engage in an aggressive style of conversation significantly more often than girls. It may be that the problem-solving context led children to be more competitive than they might be during free play because they were oriented toward the goal

of completing the tasks. As a result, both boys and girls used aggressive conversation to accomplish that goal.

Children in mixed-sex dyads asked for and received more task-related information from their partners than children in same-sex dyads. It is possible that mixed-sex dyads had more difficulty establishing a plan to carry out the tasks, and needed to exchange more information to complete them. Alternatively, mixed-sex dyads may have actually communicated more effectively than same-sex dyads, and the more frequent exchange of information was a reflection of effective, rather than ineffective, collaboration. Finally, it is possible that because boys and girls in mixed-sex dyads each brought their own styles of problem-solving and collaboration to the interaction session, they needed to exchange information more often to compensate for the differences in their approaches to completing the tasks.

For the behavior measures, children in mixed-sex dyads engaged in aggressive behaviors almost twice as often as children in same-sex dyads. Because the patterns of interaction children develop are based mainly on contact with children of the same sex, it may be more difficult in mixed-sex interactions for children to make their goals understood by their partners, and there may be more conflict as a result.

This study also revealed a number of task differences in the kinds of language and behavior exhibited by the children. First, children offered and received more information from their partners on both Tinkertoy tasks than on the bead task. The Tinkertoy tasks included more pieces for children to choose from, and children also had more choices of placement locations for those pieces. In contrast, the beads could be placed only on the string, and only in a linear fashion. Children may have consulted one another more often on the Tinkertoy tasks since they had more decisions to make. On the bead task, children's opportunities for placing task

materials were more limited, forcing children to physically interact with one another more often. Children were more likely to use mitigated behaviors to complete this task. Different task demands do, therefore, seem to stimulate different types of discussion.

One important goal for this research was to examine the relationships between children's conversation and their behavior during and performance on the tasks within pair type. The results revealed that, in fact, some of the relationships between language and performance did differ across pair types. For example, giving reasons was associated with better performance for females in same-sex dyads and worse performance for males in same-sex dyads on the model-copying Tinkertoy task. Miscellaneous talk was also associated with correct selections for girls in same-sex dyads on this task. According to previous research, offering justifications and using conversation to build and maintain relationships occur more often in female same-sex interactions (McCloskey & Coleman, 1992; Sheldon, 1990). In addition, counters were associated with worse performance for girls in same-sex dyads, but not for the other two pair types. Girls who frequently disagreed with one another appeared to suffer in terms of their performance on the model-copying Tinkertoy task. For this task, then, the findings converge with previous research on girls' free play interactions which suggests that girls use conversation to avoid conflict and pursue joint goals. The present research provides the first evidence that this kind of conversation also appears to play an important role in girls' problem-solving interactions.

It is interesting to note that on the bead task, it was boys' performance that was negatively affected by both aggressive speech and aggressive behavior, and positively affected by giving reasons for behavior. The possibility that a typically masculine conversational style could actually put males at a disadvantage in particular contexts has not been addressed by the free play literature, and deserves further study.

In a similar vein, mitigated conversation was negatively related to several measures of children's performance for mixed-sex pairs on the Tinkertoy task. Miscellaneous talk was also negatively correlated with task performance in these dyads. These findings suggest that a typically feminine conversational style may be detrimental to performance for children in mixed-sex dyads. It may be that children in these dyads proposed joint plans that were ignored in favor of incorrect alternatives, or it may be that the joint plans themselves were incorrect. Future studies that include a variety of tasks will be necessary to determine whether gender-typed patterns of conversation have differential effects on performance based on the gender composition of the dyad.

Preschoolers are often viewed as being rather unskilled at collaboration because they are often egocentric, may lack good verbal negotiation skills, and are unable to achieve the shared state of understanding thought to be necessary for effective collaboration (Azmitia, in press; Tomasello et al., 1993). The preschool children in this study, however, were capable of coordinating their interactions in order to complete the problem-solving tasks. In fact, all of the children in the study completed all three tasks. In addition, nearly all of the interactions involved discussion about how to complete the tasks, how to deal with problems or mistakes, and division of materials and labor. Finally, the children used a wide variety of verbal strategies to accomplish these goals, including some strateges like mitigation and problem-solving that are often thought to be present only in older children's interactions. Together, the findings from the present research indicate that a more positive view of what young children are able to accomplish in joint problem-solving interactions is needed.

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